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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/724,713	12/02/2003	Yoshihiro Ikoma	65933-055	2215

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EXAMINER	
CHUO, TONY SHENG HSIANG	
ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/724,713	IKOMA, YOSHIHIRO	
	Examiner	Art Unit	
	Tony Chuo	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 June 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,9-12 and 17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,9-12 and 17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *10 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/22/08 has been entered.

Response to Amendment

2. Claims 1-4, 9-12, and 17 are currently pending. Claims 5-8 and 13-16 are cancelled. New claim 17 has been added. The previous objection to claim 1 is withdrawn. The amended claim 1 does not overcome the previously stated 103 rejection. However, new claim 17 does overcome the previously stated 103 rejection. Therefore, upon further consideration, claims 1-4, 9-12, and 17 are rejected under the following new and previously stated 103 rejections.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buche et al (WO 03/058735) in view of Koschany et al (US 6451470).

The Buche reference discloses a PEM fuel cell comprising an anode, a cathode, and a solid electrolyte membrane between the anode and cathode, wherein the cathode comprises a gas diffusion substrate, and an electrocatalytic layer formed on the gas diffusion substrate, and wherein the electrocatalytic layer comprises a platinum supported carbon black, a proton-conducting polymer, and particulate graphite at a loading of 1-40wt%.

However, Buche et al does not expressly teach a second carbon particle in the catalyst layer that is in a range of 10wt% to 50wt% with respect to a weight of the entire catalyst layer. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Buche electrode to include a second carbon particle in the catalyst layer that is in a range of 10wt% to 50wt% with respect to a weight of the entire catalyst layer because product claims with numerical ranges which overlap prior art ranges were held to have been obvious (*In re Wertheim* 191 USPQ 90 (CCPA 1976).

However, Buche et al does not expressly teach a gas diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer. The Koschany reference discloses a first gas diffusion layer comprising a carbonized carbon fiber nonwoven fabric that is filled

with soot (first hydrophilic carbon particle) and graphite (second hydrophobic carbon particle), wherein the content of graphite in the first gas diffusion layer is 7% of 7 mg/cm^2, which is 0.49 mg/cm^2, which is 4.9 wt% with respect to the weight of the entire gas diffusion layer (See Example 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Buche electrode to include a gas diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer in order to maintain a high effective diffusion constant for reaction gases and a low effective diffusion constant for water so that water content is balanced in the electrode.

5. Claims 2-4 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buche et al (WO 03/058735) in view of Koschany et al (US 6451470) as applied to claims 1 and 9 above, and further in view of Terazono et al (US 2002/0009626).

However, Buche et al as modified by Koschany et al does not expressly teach an average value of lattice spacing of the [002] plane, $L_c(002)$, of the second carbon particle that is between 0.337nm and 0.348nm and a crystallite size in a direction of c-axis, $L_c(002)$, of the second carbon particle that is between 3nm and 18nm. The Terazono reference discloses a graphitized carbon support for a catalyst layer that has an average lattice spacing of d_{002} of 0.341 and a crystallite size L_c of 3.5 nm (See paragraph [0008],[0048]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize graphitized carbon particles having the above cited properties as the hydrophobic carbon black particles in the Buche/Koschany electrode in order to provide adequate water repellency which is controlled by the degree of graphitization of the carbon black particles (See paragraphs [0013],[0016],[0075]).

6. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasumoto et al (JP 2000-243404) in view of Koschany et al (US 6451470).

The Yasumoto reference discloses a fuel cell comprising: an anode, a cathode, and a solid polymer electrolyte membrane placed between the anode and cathode, wherein both the anode and cathode comprise a gas diffusion layer; and a catalyst layer formed on the gas diffusion layer; wherein the catalyst layer comprises catalyst particles supported on a hydrophilic carbon powder, polyelectrolyte (ion exchange resin), and a water-repellent carbon material; and wherein the content of the water-repellent carbon material in the catalyst layer is about 16 wt% with respect to a weight of the entire catalyst layer (See Abstract and paragraph [0024]).

However, Yasumoto et al does not expressly teach a gas diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer. The Koschany reference discloses a first gas diffusion layer comprising a carbonized carbon fiber nonwoven fabric that is filled with soot (first hydrophilic carbon particle) and graphite (second

hydrophobic carbon particle), wherein the content of graphite in the first gas diffusion layer is 7% of 7 mg/cm^2, which is 0.49 mg/cm^2, which is 4.9 wt% with respect to the weight of the entire gas diffusion layer (See Example 2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yasumoto electrode to include a gas diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer in order to maintain a high effective diffusion constant for reaction gases and a low effective diffusion constant for water so that water content is balanced in the electrode.

7. Claims 2-4 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasumoto et al (JP 2000-243404) view of Koschany et al (US 6451470) as applied to claims 1 and 9 above, and further in view of Terazono et al (US 2002/0009626).

However, Yasumoto et al as modified by Koschany et al does not expressly teach an average value of lattice spacing of the [002] plane, $L_c(002)$, of the second carbon particle that is between 0.337nm and 0.348nm and a crystallite size in a direction of c-axis, $L_c(002)$, of the second carbon particle that is between 3nm and 18nm. The Terazono reference discloses a graphitized carbon support for a catalyst layer that has an average lattice spacing of d_{002} of 0.341 and a crystallite size L_c of 3.5 nm (See paragraph [0008],[0048]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize graphitized carbon particles having the above

cited properties as the water repellent carbon material in the Yasumoto/Koschany electrode in order to provide adequate water repellency which is controlled by the degree of graphitization of the carbon black particles (See paragraphs [0013],[0016],[0075]).

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yasumoto et al (JP 2000-243404) in view of Koschany et al (US 6451470) as applied to claim 1 above. In addition, Koschany et al also disclosed a first gas diffusion layer comprising 44% soot (first carbon particle) (See column 5, lines 54-61).

However, Yasumoto et al as modified by Koschany et al does not expressly teach a content of the first carbon particle in the gas diffusion layer that is in the range of 1 wt% to 20 wt% with respect to a weight of the entire gas diffusion layer. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yasumoto electrode to include a content of the first carbon particle in the gas diffusion layer that is in the range of 1 wt% to 20 wt% with respect to a weight of the entire gas diffusion layer because it has been held that the discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art (*In re Boesch*, 205 USPQ 215 (CCPA 1980)). The content of the first hydrophilic carbon particle in the gas diffusion layer is a result effective variable of restricting the diffusion of water vapor in order to balance the water content in the gas diffusion electrode.

9. Claims 1, 9, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasumoto et al (JP 2000-243404) in view of Chiem et al (US 2003/0008195).

The Yasumoto reference discloses a fuel cell comprising: an anode, a cathode, and a solid polymer electrolyte membrane placed between the anode and cathode, wherein both the anode and cathode comprise a gas diffusion layer; and a catalyst layer formed on the gas diffusion layer; wherein the catalyst layer comprises catalyst particles supported on a hydrophilic carbon powder, polyelectrolyte (ion exchange resin), and a water-repellent carbon material; and wherein the content of the water-repellent carbon material in the catalyst layer is about 16 wt% with respect to a weight of the entire catalyst layer (See Abstract and paragraph [0024]).

However, Yasumoto et al does not expressly teach a gas diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer. The Chiem reference discloses a gas diffusion layer comprising a nonwoven carbon fiber that has a density of 34 g/m^2 (3.4 mg/cm^2) that is loaded with carbon black (first hydrophilic carbon particle) and graphite (second hydrophobic carbon particle), wherein the ratio of carbon black to graphite is less than about 50:50, which results in a loading composition of 33.5% graphite and 33.5% carbon black and an amount of loading material of 8 mg/cm^2, which results in 23.5 wt% graphite and 23.5 wt% carbon black with respect to the weight of the entire gas diffusion layer (11.4 mg/cm^2) (See paragraphs [0017],[0034],[0035],[0042], [0052]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yasumoto electrode to include a gas

diffusion layer that includes the first carbon particle and the second carbon particle, wherein a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer in order to utilize an electrode with a certain loading of carbon black and graphite that would improve the operational performance of the electrode.

However, Yasumoto et al as modified by Chiem et al does not expressly teach a content of the first carbon particle in the gas diffusion layer that is in the range of 1 wt% to 20 wt% with respect to the weight of the entire gas diffusion layer.

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Yasumoto electrode to include a content of the first carbon particle in the gas diffusion layer that is in the range of 1 wt% to 20 wt% with respect to the weight of the entire gas diffusion layer because it has been held that the discovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art (*In re Boesch*, 205 USPQ 215 (CCPA 1980)). The amount of hydrophilic carbon particle in the gas diffusion layer is a result effective variable of restricting the diffusion of water vapor in order to balance the water content in the gas diffusion electrode. In addition, the Chiem reference discloses that those skilled in the art will appreciate that various properties of the gas diffusion layer substrate and loading material such as wettability can be controlled to a certain extent by varying the amounts of loading material (See paragraph [0049]). Further, there is no evidence of the criticality of the claimed range of content of the first carbon particle.

Response to Arguments

10. Applicant's arguments filed 5/22/08 have been fully considered but they are not persuasive.

The applicant argues that Buche, Yasumoto, and Koschany do not disclose setting the content of the second carbon particle in the gas diffusion layer as required by claim 1. Although the Koschany reference discloses three gas diffusion layers that are used for the gas diffusion electrode, the first layer is construed as the gas diffusion layer that has the catalyst layer formed thereon. The amended claim 1 does not preclude the addition of a second and third gas diffusion layer. Therefore, the first gas diffusion layer of Koschany still reads on the limitation "a content of the second carbon particle in the gas diffusion layer is in the range of 3 wt% to 30 wt% with respect to a weight of the entire gas diffusion layer".

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tony Chuo whose telephone number is (571)272-0717. The examiner can normally be reached on M-F, 9:00AM to 5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TC

/Jonathan Crepeau/
Primary Examiner, Art Unit 1795